DOCUMENT RESUME

ED 221 719 CE 033 898

AUTHOR Pribyl, Paul F.
TITLE Rope Practices. Fire Service Certification Series. Unit FSCS-FF-5-80.
INSTITUTION Wisconsin State Board of Vocational, Technical, and Adult Education, Madison. Bureau of Program Development and Operations.
PUB DATE 80
NOTE 18p.; For related documents, see CE 033 897-915.
AVAILABLE FROM Wisconsin Board of Vocational, Technical and Adult Education, P.O. Box 7874, 4802 Sheboygan Avenue, 7th Fl., Madison, WI 53707 (Free to educational agencies).

EDRS PRICE MF01/PC01 Plus Postage.
DESCRIPTORS Behavioral Objectives; Course Descriptions; *Equipment Utilization; *Fire Fighters; *Fire Protection; *Fire Science Education; Learning Activities; Lesson Plans; Postsecondary Education; Teaching Guides; Units of Study
IDENTIFIERS Knot Tying; *Ropes; Wisconsin

ABSTRACT

This training unit on rope practices is part of a 17-unit course package written to aid instructors in the development, teaching, and evaluation of fire fighters in the Wisconsin Fire Service Certification Series. The purpose stated for the 8-hour unit is to teach the fire fighters how to use rope in various ways. An instructor's guide sheet provides this information: introduction to the topic, instructor preparation, length of unit, methods of instruction, testing, equipment and facilities required, recommended visual aids, and references. Following a list of unit objectives, a lesson plan outlines the main teaching points and states the preferred teaching method, cites the reference and page number(s) where the information is to be found, and indicates the necessary handouts. Other contents in the unit include a unit quiz, answer key to the quiz, and handouts (graphs, student worksheets, informational material, and forms). (LYB)

****
* Reproductions supplied by EDRS are the best that can be made *
* from the original document. *
****

ED221719

WISCONSIN BOARD OF VOCATIONAL, TECHNICAL AND ADULT EDUCATION
4802 Sheboygan Avenue, Madison, Wisconsin 53702
Robert P. Sorensen, Ph.D., State Director

FIRE SERVICE CERTIFICATION SERIES

UNIT FSCS-F7-5-80

ROPE PRACTICES

FIRE SERVICE TRAINING

Simon L. Hertzler
Vocational Education Consultant

Paul F. Pribyl
Vocational Education Consultant

BUREAU OF PROGRAM DEVELOPMENT

George R. Kinsler
Bureau Director

Arnold H. Potthast
Chief Supervisor
Vocational Education

CE 033 898

CONTENTS

	PAGE
INTRODUCTION	1
INSTRUCTOR GUIDE SHEETS	2
OBJECTIVES	3
LESSON PLANS	4-10
UNIT QUIZ	11-12
ANSWER KEY	13
APPENDIX	
HANDOUT MATERIAL	14

ROPE PRACTICES

Prepared by:

Paul F. Pribyl, Consultant
Fire Service Training

INTRODUCTION

Rope is one of the most versatile and valuable items used by fire departments. It can be used for anything from a life line to a means for hoisting, lowering, anchoring, rigging, or even crowd control. When arranged with pulleys or more complex block and tackle set-up, rope can be used to greatly increase a firefighter's muscle power and lifting ability. A rather simple combination of pulleys, for example, can multiply lifting ability by six times. The rope itself must be of high quality to withstand the stresses such uses would exert on the rope. Therefore, it is important for the fire fighter to know both how to use the rope in various ways and also know as much as possible about the rope itself.

INSTRUCTOR PREPARATION

Carefully study the objectives to determine the goals that have been set for the firefighters upon completion of this unit.

Review the lesson plans and if necessary, consult the references listed.

Develop suitable audio-visual aids, provide training area and necessary tools and equipment to effectively teach this unit.

LENGTH OF UNIT

Classroom work	2 hours
Practical Skills Testing	5 hours
Evaluation and Testing	1 hour

METHODS OF INSTRUCTION

ILLUSTRATION AND DEMONSTRATION
LECTURE/DISCUSSION

Suggested methods and techniques are listed under Instructor's Notes on the lesson plans. For further information consult Fire Service Instructor Training, IFSTA #303, 3rd ed., pp. 71-83.

TESTING

At the end of this unit, a written quiz of five or more questions will be given.

EQUIPMENT AND FACILITIES REQUIRED

Appropriate training aids and necessary equipment
Lengths of rope for student practice
150 ft lengths of the various diameter
and types of lines
Area where necessary evolutions can be performed safely

REFERENCES

1. Hudiburg, E. and McCoy, C., Ed., FIRE SERVICE PRACTICES FOR VOLUNTEER FIRE DEPARTMENTS, #201, IFSTA, Stillwater, 5th ed., 1971, pp. 31-49, 40

2. Hudiburg, E. and McCoy, C., Ed., FIRE SERVICE RESCUE AND PROTECTIVE BREATHING PRACTICES, #108, IFSTA, Stillwater, 4th ed., 1969, pp. 65-92

3. Hudiburg, E. and McCoy, C., Ed., FORCIBLE ENTRY, ROPE AND PORTABLE EXTINGUISHER PRACTICES, #101, IFSTA, Stillwater, 6th ed., 1978, pp. 103-111, 117-134, 144-146

4. Peige, J., Ed., ESSENTIALS OF FIRE FIGHTING, #200, IFSTA, Stillwater, 1st ed., 1977, pp. 25-35, 157, 224-226

OBJECTIVES

All objectives in this unit are to be met according to the material contained in the International Fire Service Training Association Manuals #101 Forcible Entry, Rope, and Portable Extinguisher Practices, #108 Fire Service Rescue and Protective Breathing Practices, #200 Essentials of Fire Fighting, #201 Fire Service Practices for Volunteer Fire Departments.

To satisfactorily coplete this unit, the firefighter must attain a grade of 70 or higher on the written quiz and succesfully complete the practical skills examination.

NFPA STANDARD 1001

ROPE PRACTICES

FIRE FIGHTER I

3-5 Ropes

3-5.1 The fire fighter when given the name, picture or actual knot used by the department, shall identify it, and describe the purpose for which it would be used.

3-5.2 The fire fighter, when given the proper size and amount of rope shall demonstrate tying a bowline knot, a clove hitch, and a becket or sheet bend.

3-5.3 The fire fighter, given the proper rope, shall demonstrate the bight, loop, round turn and half hitch as used in tying knots and hitches.

3-5.4 The fire fighter, using an approved knot, shall hoist any selected forcible entry tool, ground ladder, or appliance to a height of at least 20 feet.

3-5.5 The fire fighter shall demonstrate the methods of inspecting, cleaning and maintaining rope.

FIRE FIGHTER II

4-5 Ropes

4-5.1 The fire fighter, when given a simulated fire fighting or rescue task, shall select the appropriate size, strength and length of rope for the task.

4-5.2 The fire fighter shall select and tie a knot between two objects at least 15 feet apart, using an apporved hitch or knot, that will support the weight of a fire fighter on the rope.

4-5.3 The fire fighter shall demonstrate the use of rope, using approved knots and hitches, to tie ladders, hose and other equipment, so as to secure them to immovable objects.

COURSE: FIRE SERVICE CERTIFICATION SERIES

LESSON: ROPE PRACTICES

EQUIPMENT NEEDED: SLIDE, OVERHEAD PROJECTORS, SCREE

TRAINING AIDS: SLIDES, TRANSPARENCIES, TEXTS

INSTRUCTORS NOTES	TEACHING POINTS
Ref: Forcible Entry, Rope and Portable Extinguisher Practices, #101, IFSTA 6th ed., pp. 103-115	Introduction to Ropes
Objectives 3-5.1 4-5.1 4-5.2 4-5.3 are covered in the practical skills test section p. 103	I. Physical Characteristics of Rope Because of the critical life-safety situations in which rope may be used, it must be understood that fire service rope is special and only superficially resembles the ordinary rope used by the average lay person. Within the specialized are of fire service operations there is still much possible variation. One of the reasons why a study of rope characteristics is important is because it enables firefighters to more efficiently select the kind of rope most suitable for the need. Rope may be classified according to the type of fiber used in making the rope. The general classifications are: A. Natural Fiber Rope
p. 104	1. Manila rope
4-5.1	a. fiber of abaca leaf stems b. Good strength and durability c. Little stretch d. Poor mildew resistance e. Most popular in fire service
P. 105	2. Sisal rope (vegetable fiber rope) a. Hard fiber of agave plant b. 3/4 strength of manila c. swells when wet

INSTRUCTORS NOTES	TEACHING POINTS
p. 105	A. Natural Fiber Rope
	3. Cotton rope
	a. soft fiber of cotton plant
	b. weakness after wet
	c. less than 1/2 strength of manila
p. 105-106	B. Synthetic Fiber Rope
	1. Nylon rope
	a. strongest for weight or size
	b. synthetic
	c. best for impact loading
	(1) 3-3½ times the tensile strength of cotton rope
	(2) 1½-2½ times stronger than manila rope
	(3) 2-3 times stronger than sisal rope
	For example: ½ inch diameter nylon rope has a strength about equal to 5/8 inch diameter manila, which saves about 40% in weight
	d. will not rot or mildew
p. 106	2. Polyproplene Rope
	a. synthetic
	b. Most light weight
	c. high relative strength
	3. Polyethylene rope
	a. synthetic
	b. similiar to polyproplene rope

INSTRUCTORS NOTES

TEACHING POINTS

p. 107

II. Rope Construction

A. Hawser

1. fibers twist, yarn twist,strans twist - hawser

2. Most common in fire service

B. Shroud

1. 4 - strands

2. Around a core

C. Cable

1. More than four strands

2. Plaited (over and under) or twisted

III. Testing Strength of Rope

A. Tensile strength - force required to break a rope of unit of cross sectional area.

B. Breaking strength - load under which rope will fail.

IV. Care and Maintenace of Rope

A. Factors in deterioration of rope

1. Exposure
2. Wear

B. Maintenace Recommendations

1. Do not drag on rough surfaces

2. Avoid sharp bends

3. Avoid oils and chemicals

4. Wash regularly

5. Dry correctly

6. Inspect often

3-5 Rope Practices

3-5..5

INSTRUCTORS NOTES | TEACHING POINTS

3-5.5

V. Using Rope Safely

For safety's sake. periodically examine your rope, particularly after each use. Be sure all ropes are safe by carefully inspecting them.

A. Inspection

The surface appearance of used rope is sometimes in itself and by examination of each rope over its entire length, you may avoid accidents.

1. Inspect surface for cuts abrasions and spots that indicate acide damage.

2. If a rope has a musty odor or shows brownish spots inspect by untwisting (every three feet)

3. If the fibers:

   a. break easily
   b. show separation
   c. lose luster
   d. are charred or melted
   e. show signs of discoloration, decay or chemical damage

DISCARD THE ROPE

B. Life Lines

Rope of ample size, length and tensile strength which provides an emergency means for firefighters to descend from upper floors or roofs of buildings to the ground .

1. Ordinarily two persons are all that will be placed on a lifeline at any one time.

   a. Weight not to exceed 500 pounds

2. Always use life belt or approved descending apparatus and gloves.

3. Need not be especially flexible, but stiffness not desired.

4. Safety Factor

   a. new rope - 5 : 1

   b. used rope 10 : 1

   c. these factors good for general fire fighting

INSTRUCTORS NOTES

TEACHING POINTS

4-5.1

B. Life Lines

5. Usually from 100 to 150 feet in length

The following kinds and sizes of life lines are most desirable:

KIND OF ROPE	SIZE OF ROPE
Manila	3/4 and 7/8 inch diameter
Nylon	3/4 and 7/8 inch diameter

C. Hoisting or Anchoring Ropes (Utility Ropes)

1. 3/8 to 5/8 inch diameter

2. Must handle easily

3. Not used for victim handling

D. Ladder Halyard

1. Consider load

2. 5 : 1 ratio for safety

3. Match to pulley

4. Do not neglect inspecting

E. Roping off Areas

1. Use half sheep shank and chimmney hitch

2. Can be tightened at intervals

VI. Principles of Tying Knots

Due to the vital nature associated with need for using ropes, the firefighter must be familiar enough with the equipment and techniques of ropes to work quickly and accurately.

A. Parts of A Rope

1. Standing Part - that part of the rope used for work such as hoisting pulling and snubbing

INSTRUCTORS NOTES	TEACHING POINTS
p. 118-132	VI. Principles of Tying Knots
	A. Parts of A Rope
	2. Running Part - that part of the rope used in forming the knot as it is being folded together
3-5.3	3. Bight - formed by bending the rope and keeping the sides parallel
	4. Loop - made by crossing the side of the bight
	5. Round Turn - further bending of one sode of the loop
3-5.1	B. Knots and Uses
	1. Square Knot - joins two ropes of equal sizes and releases quickly
3-5.2	2. Becket bend - joins two ropes of unequal size and is quick to tie, releases easily
3-5.2	3. Clove Hitch - fastens rope to cylindrical object, won't slip, and you don't need an end to tie
	4. Timber Hitch - temporary hitch, easily untied and lifts roun objects
	5. Sheepshank - shortens a rope temporarily
3-5.2	6. Bowline - cannot slip, unties easily and forms a loop of a certain size
	7. Bowline on a bight - will not slip, can be formed in the middle of a rope and forms two equal sized loops
	8. Chimmney Hitch - used to take up slack in a rope, easily untied, and is adjustable
4-5.2	9. Half Sheepshank with Safety - pulls a rope taut
	10. Rescue Knot - used to lift a person, does not pull tight around chest, and will not slip

INSTRUCTORS NOTES	TEACHING POINTS
p. 132	VII. Hoisting Tools and Equipment
	A. Hoisting Ladders
3-5.4	1. Use bowline to form large knot
	2. One third distance from the top
	3. Standing part should be:
	a. between ladder and building for hoisting b. outside of ladder for lowering
	B. Hoisting Hose
	1. Use clove hitch with safety and half hitch
	2. Double hose back to protect nozzle or coupling
	C. Hoisting an Extinguisher
	1. Use a clove hitch and half hitch
	D. Hoisting an Axe
	1. Form a clove hitch around the head of the axe, secure it with a half hitch near the head and add another half hitch on the end of the handle.
	E. Hoisting a pike pole
	1. Use a clove hitch and half hitch
	VIII. Storing Hose
	A. Coiling
	1. To store rope so that it may be placed in service with a minimum of delay
	B. Bagging
	1. Storing coiled line in a canvas bag 12 x 32 inches for 150 feet of 3/4 inch manila

UNIT QUIZ

1. State four (4) uses of rope in the fire service:

_____

_____

_____

_____

2. Which of the following types of rope construction is most commonly found in the fire service:

   (Circle the letter at the correct answer)

   a. Shroud

   b. Hawser

   c. Cable

3. List two materials used to make ropes for the fire service:

_____

_____

4. Name two types of rope that are made of vegetable fiber

_____

_____

5. The two most important factors in the deterioration of rope are exposure and _____

   (Circle letter at correct answer)

   a. softness

   b. loss of luster

   c. wear

   d. fibers break easily

6. 6. List two maintenance rules concerning rope.

_____

_____

7. List three items to look for when inspecting a rope.

_____

_____

_____

8. Define the term "Standing Part" of a rope.

_____

_____

9. Define the "Running Part" of a rope

_____

_____

10. The becket knot is used for;

(Circle the letter at the correct answer)

a. To join two ropes of equal size

b. To tighten a line

c. To join two lines of unequal size

d. To hoist equipment

ANSWER KEY

1. Life line
   Hoisting equipment
   ladder halyard
   Anchoring hose, ladders and hose rollers
   Control of ladder pipes
   rescue operations

2. b. Hawser

3. Sisal
   Cotton
   Manila
   Nylon
   Dacron
   Polypropylene
   polyethylene

4. sisal rope
   manila rope

5. c wear

6. Don't drag on rough surfaces
   Avoid sharp bends
   Avoid oils and chemicals
   Wash regularly
   Dry correct;r
   Inspect often

7. Inspect inside strands or fibers
   check for cuts, abrasions
   Check for charring or melting
   Check for extreme softness
   Check for discoloration, decay or signs of chemical damage

8. Part that does the work

9. part that ties or forms the knot

10. c. to join two lines of unequal size.

APPROXIMATE MINIMUM BREAKING STRENGTHS OF NEW ROPE				
Diameter	3-Strand Nylon	3-Strand Manila	3-Strand Sisal	3-Strand Cotton
1/4 inch	1,200 pounds	600 pounds	500 pounds	400 pounds
3/8 inch	2,700 pounds	1,300 pounds	1,000 pounds	900 pounds
1/2 inch	5,000 pounds	2,600 pounds	2,100 pounds	1,500 pounds
5/8 inch	8,000 pounds	4,400 pounds		
3/4 inch	11,000 pounds	5,400 pounds	4,300 pounds	3,100 pounds
7/8 inch	15,000 pounds	7,700 pounds		
1 inch	20, 000 pounds	9,000 pounds	7,200 Pounds	5,100 pounds